Catchment Based Approach

Chalk Stream Restoration Strategy 2021

Executive summary

This CaBA Chalk Stream Restoration Strategy was written and collated by Charles Rangeley-Wilson, chair of the CaBA chalk stream restoration group, (CSRG) in consultation with:

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In addition, a wider stakeholder group (see acknowledgements page 137) comprising individuals, academics, river keepers, fishery managers, farmers and landowners, chalk-stream associations, angling clubs and staff from numerous regulatory, independent and third-sector organisations have made contributions at the draft consultation stage and during river walks in June and August 2021 and in direct correspondence with the CaBA CSRG.

Numerous Environment Agency and Natural England staff have contributed their expertise with passion and enthusiasm, as have representatives from the water companies covering chalk catchments.

CaBA CSRG is grateful for all their valuable, expert and passionate contributions.

1. Introduction

Chalk streams are an exceptional type of spring-fed river distinct to England and parts of France and Denmark. Although chalk exists in other parts of the world, nowhere else is there such a mass of it – the remains of an entire sea-floor – exposed at the surface of the earth as rolling chalk hills, enfolding the clear-watered rivers we call chalk streams.

The English chalk downland gives rise to 283 distinct chalk streams as well as dozens of small, nameless rills and becks, comprising the vast majority of this river type to be found anywhere in the world. They are our equivalent to the Great Barrier Reef or the Okavango: a truly special natural heritage and a responsibility.

When rain falls on chalk hills it soaks down into the body of the rock and there undergoes a kind of alchemy, emerging from springs as cool, alkaline, mineral-rich water, equable in flow: the perfect properties to create a richly diverse eco-system.

Ecologically rich and biodiverse

Chalk streams in their natural condition are home to a profusion of life. Botanically they are the most biodiverse of all English rivers. For invertebrates, fish, birds and mammals, they offer a vast range of habitat niches. In Wessex they are a stronghold of our chalk-stream Atlantic salmon, now known to be genetically distinct. The upper ephemeral reaches, known as winterbournes, are global hotspots for a unique range of specialist plants and invertebrates.

Under pressure

But chalk streams are under immense pressure: they flow through one of the most urbanised, industrialised and farmed parts of the UK. Three chalk streams flow through London and there are many more in the chalk hills that surround the capital. Further afield, though many flow through more open countryside, that countryside is busily farmed, while villages or towns are sited somewhere along most chalk rivers. All these streams are impacted in one way or another by the activities of people.

We depend on chalk streams for public water supply, and have leant heavily on the resources of the underground body of water that feeds these streams. And yet every litre of water we take out of the aquifers – and we take billions and billions of litres to irrigate our crops, or run our taps – is water lost to the natural environment. Lost, that is, until we put it back. Only by the time we return water to these rivers it is no longer in the state in which we found it and has bypassed long reaches of the stream. It has passed through our sewage systems, becoming rich in nutrients and other pollutants. We may treat it, we may even treat it to a very high standard in some places, but in many others we do not. Routinely, we put back into these wonderful ecosystems water which makes them eutrophic, so that oxygen is sucked away from the river life which depends on it.

Even the water which we do not take out, which actually makes it to the underground aquifer or the stream, is unnaturally changed by human activities.

Our heavily farmed landscape exerts a huge pressure on water quality, either because rain runs off the land and along roads, accumulating harmful chemicals and nutrients along the way, or because it seeps down into the ground carrying with it the chemical fertilisers which have been applied to the land. There is now so much nitrogen in our chalk aquifers that we do not know how long it will take – even if we stopped applying nitrogen as fertiliser – for the aquifers to become clean again.

Finally, we have changed the rivers themselves, modifying them heavily over the centuries. We have used them for milling, for transport, to drive multiple agricultural and industrial revolutions. More recently, in the post-war decades, we made one of the most drastic and permanent changes of all: we dredged them. We took out the gravel river-bed – on which almost all chalk-stream life ultimately depends – and dumped it on the banks, all in an ultimately misguided attempt to drain the landscape.

Our challenge

So, we have a job ahead of us if we are to leave our wonderful chalk streams in a better state than we found them.

That is the challenge which this **CaBA chalk stream restoration strategy** will attempt to address – how to restore good ecological health to these unique rivers and the landscapes which support them.

CaBA is a space in which all stakeholders involved in the management, conservation and sustainable exploitation of our chalk streams can come together and agree on a way to achieve that goal. It is not always a comfortable space: NGO's have to be pragmatic; water companies have to be idealistic; businesses, especially agriculture, have to adapt and be supported to do so: government has to listen and act.

This restoration strategy is what has come out of that discussion: an action plan which, if followed, will allow us to become proud custodians of 283 ecologically vibrant chalk streams from Dorset to Yorkshire, streams that may once more flow with a healthy flush of clean water through meandering channels over bright gravel, full of wildlife, beside which it is a pleasure to spend time and which could and should be a credit to the stewardship of our generation.

2. The trinity of ecological health

Chalk-stream ecological health depends on three things. This plan addresses each in turn and all three in combination:

• water quantity (the naturalness of the flow regime)

• water quality (how clean the water is)

• physical habitat quality (the physical shape of the river, but incorporating biological factors like invasive species which can degrade habitat directly and indirectly)

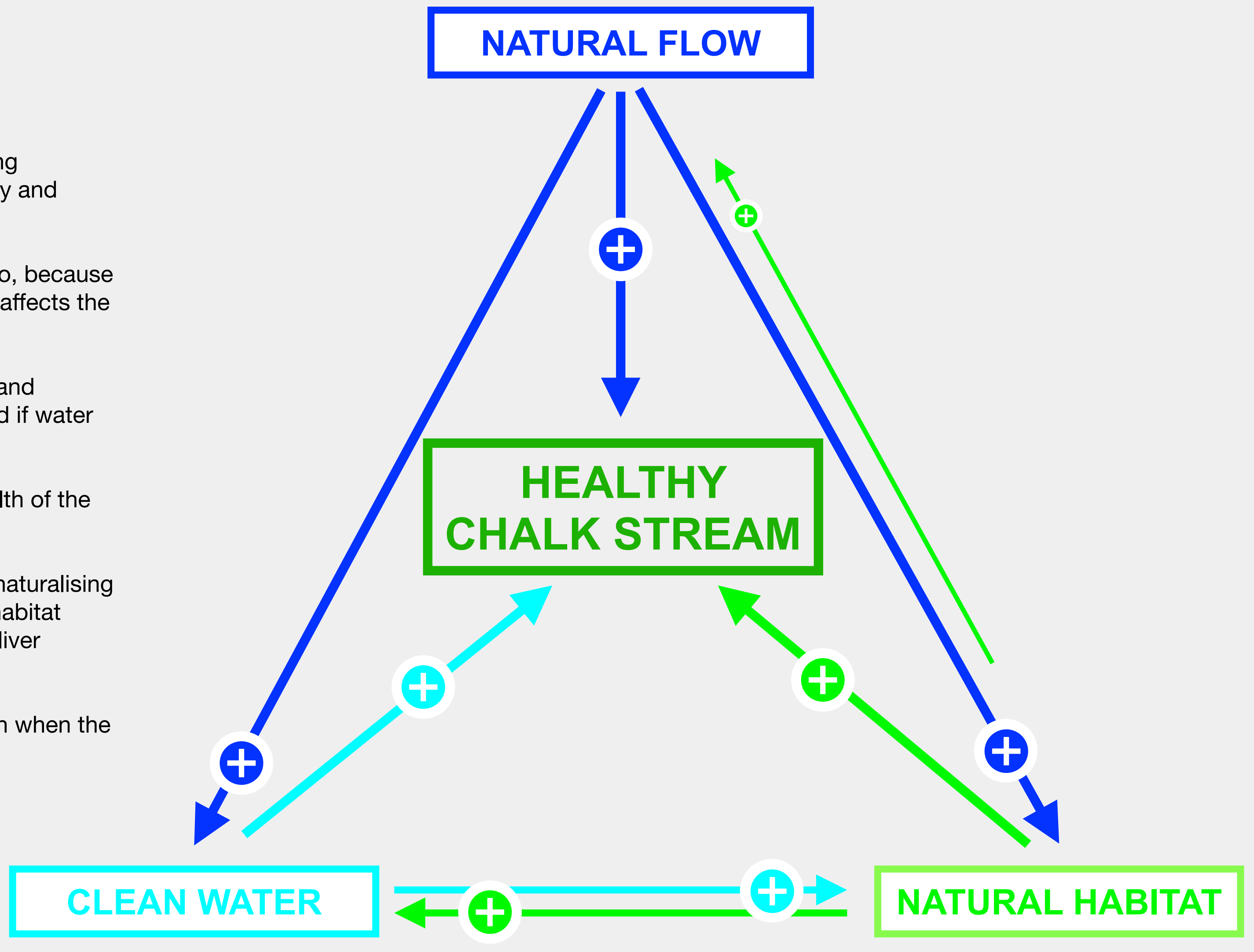
We look at these issues singly because it helps to focus, but together too, because it is important to remember how each one either positively or negatively affects the others.

Re-naturalising flow will improve river health by improving water quality and physical habitat. But the benefit of renaturalising flow is greatly increased if water quality and physical habitat are improved too.

Improving water quality or physical habitat will likewise enhance the health of the chalk stream although not as much as when flow is also renaturalised.

Therefore the best restoration strategy will address all three together: renaturalising flow and improving water quality while using landscape-scale physical-habitat improvements to consolidate the beneficial impacts of both and thus deliver maximum ecological improvement.

Combining all three will achieve this outcome much more effectively than when the elements are only improved in isolation.



A simple diagram illustrating the positive correlations between flow, water quality and physical habitat, to show how positive gains in ecological health are maximised by making improvements to all three components.
The arrows may be reversed for negative correlations, showing how water quality and habitat diminish as flow is lost to abstraction, for example.

Water quantity: restoring flow

Water quantity

• Groundwater abstraction from chalk aquifers accelerated markedly in the post-war years, peaking in the mid-1980s when in some catchments over half of the water available to the river – and in dry years, all of it – was abstracted.

• A multi-year drought in the late 1980s early 1990s brought the scale of this crisis to pubic attention. The National Rivers Authority identified 15 chalk streams which were suffering from acute over-abstraction and launched a scheme to address the issue called Alleviation of Low Flows. Thirty years later only five of those fifteen chalk streams have flows which support good ecological status (GES), a Water Framework Directive (WFD) requirement.

• In the interim period, multiple reports have identified actions to tackle unsustainable abstraction in chalk streams, and some action has been taken: the Environment Agency's (EA) Restoring Sustainable Abstraction programme has delivered alterations to 124 abstraction licences on chalk streams, returning 105 Ml/d of water to the environment. The government has changed the law with regard to compensating abstractors when licences are revoked or changed. The EA has established environmental flow targets.

• Still many chalk streams suffer from acute and chronic low flows. In the most recent WFD assessment cycle, 75 chalk streams were assessed as does not support GES for flow.

• WFD assessments use Environmental Flow Indicators (EFI) to show what levels of flow are needed to support good ecological status. For the most sensitive watercourses, the target is for no more than a 10% reduction from the natural flows during low flow periods (generally late summer/early autumn). In reality, the flows in some of the most stressed chalk streams are far below this: the River Ver, for example, is 77% below natural, the Chess 41%.

• A significant part of why this crisis has proved so insoluble is that there is an immense pressure on public water supply in a heavily populated and dry part of the country, only limited water sources are available and finding other sources is expensive.

• The national framework for water resources offers the best chance yet to re-naturalise chalk-stream flows by looking for water-resource options which are not based solely on cost. In seeking 'best value' the framework considers environmental protection and resilience alongside strategic options including reservoirs, water re-use schemes and desalination plants, shared supplies with other sectors and catchment-based work to improve water management. Chalk streams must be a priority in this process.

• Other actions which will help include:

- a consensus agreement on what constitutes sustainable abstraction and a commitment to publish and meet time-bound goals towards meeting that target
- a review of existing flow-assessment methodologies, abstraction-sensitivity banding, assessment points and waterbody boundaries
- improved water efficiency, including compulsory water metering in all chalk catchments
- ambitious per-capita demand-management targets and leakage reductions

Water quality: reducing pollution

Water quality

• In their natural state, chalk streams are gin-clear, with little sediment, low nutrient levels and stable temperatures at the spring sources of around 10-11ºC. However, pollution from point sources, especially sewage-treatment works and diffuse sources such as agricultural and road run-off, means that many suffer from elevated levels of nutrients, sediment and toxic chemicals such as pesticides.

• Excess sediment settles on and penetrates the gravels on the river bed, and has a direct impact on plants, invertebrates and fish, smothering fish eggs and clogging the interstitial spaces in the gravel where invertebrates live. It makes the water turbid, blocking photosynthesis. Nutrients and toxins accumulate in river-bed silts.

• Excess sediment largely comes from agricultural run-off (77%) in wet weather, especially during the winter. Certain forms of agriculture are particularly problematic: open-air pigs, for example, or any form that leaves fields bare in winter. Road run-off is another significant source of sediment pollution, as are fish and cress farms and sewage works.

• Nutrient pollution derives especially from unnatural levels of phosphorus and nitrogen, two chemicals essential to all life in a chalk stream, but naturally present only in very low concentrations.

• Excessive nutrients drive accelerated plant production, inhibiting root-growth, reducing resilience, limiting biodiversity and finally leading to a dominance of algae and extreme oxygen depletion, affecting all life in the chalk stream.

• Nutrient concentrations can and do rise well above their ‘trigger levels’ and to effect an improvement in ecology they have to be brought back down to below that level. However, in chalk rivers, of the two main macro-nutrients, when phosphorus is at its trigger level, nitrogen is almost invariably multiple times higher. This means that targeting reductions in phosphorus is likely to yield the greatest short-term benefits, albeit nitrogen must be tackled too. Measures to reduce phosphorus will also tend to reduce nitrogen by default.

• Nutrient pollution in chalk streams derives largely from sewage works and agricultural run-off but also from other sources such as fish farms, and septic tanks.

• Great improvements have been made in phosphorus reduction from sewage works over the past 20 years, driven by the Urban Waste Water Treatment Directive and the Water Framework Directive.

• But except in designated SSSI and SAC catchments where all sizes of sewage works have been improved, elsewhere these improvements have been confined to larger sewage works – which tend to be in the lower reaches of any given river – and works in sensitive area (SAe) catchments. Numerous small sewage works on rural chalk streams still only treat to secondary stage, which results in a lot of phosphorus being discharged into small, headwater chalk streams.

• Continuing to upgrade small sewage-treatment works must be a high priority for restoring chalk-stream health. Cost-benefit assumptions should be addressed if undesignated catchments are precluded from upgrading (as they tend to be) because improving water quality from the headwaters downstream has a beneficial impact on ecology throughout the river system.

• Phosphorus pollution from farming is largely bound up with sediment pollution: P adsorbs to sediment particles and washes into the river in wet weather.

• Nitrogen and phosphorus are soluble and wash into the aquifer too. Chalk binds phosphorus but not nitrogen and nitrogen pollution of chalk aquifers has become a vast problem.

• The agricultural sector must do its fair share to reduce nutrient pollution of chalk aquifers and direct run-off into chalk streams. Simple rules to address run-off in chalk catchments should be compulsory and enforced as part of the Sustainable Farming Incentive (SFI).

• Beyond SFI, considerable opportunities exist within the various Environmental Land Management (ELM) schemes which might enable changes to land management at catchment scale and the removal from production of critical land, prioritising headwater regeneration, spring-line fen, riparian zones and tracts of floodplain.

• Storm overflows are a significant problem and appall the public. All efforts must be taken to address the duration and frequency of storm overflows while priority protection in this respect ought to be given to chalk streams, reflecting their iconic status and global rarity.

Physical habitat: restoring process

Physical habitat quality.

• Chalk streams have been heavily modified throughout human history: deforestation, water mills, flash locks, pound locks and water meadows, the ditching and draining of floodplains, dredging and canalisation have all contributed to the modification of chalk streams at the expense of their ecological health, integrity and resilience.

Invasive non-native species such as Himalayan balsam and American signal crayfish exert a considerable adverse pressure on the ecological health and physical integrity of chalk streams. A changing climate is likely to exert a range of challenges, not least extreme weather patterns. Aspects of the way we manage the land and water in and around chalk streams, in terms of farming, urbanisation, aquaculture and fishery management, all add to the pressure these streams are under.

• These modifications all have the impact of disabling the river's ability to behave as a river naturally should.

• Chalk streams are gentle, low-energy rivers, shaped by forces which have long since retreated from the landscape (glaciation). Once damaged or modified, chalk streams are prisoners of their own nature, lacking the stream power for self-repair.

• Compared to higher-energy streams, chalk streams are much more dependent on ecological processes:

- on macrophytes interacting with flow
- on tree-fall
- on spawning salmonids mobilising gravel
- even on blackfly larvae in ranunculus beds filtering diatoms from the water

Therefore chalk-stream restoration should restore that which enables process:

- stream slope
- an intact gravel bed
- a dynamic interaction with fallen trees and living riparian trees
- a dynamic interaction with the floodplain

The aim – by means of the above – should be to restore ecological processes and the habitat requirements of the ecosystem's engineers (fish, insects, mammals and plants) which shape a truly heterogenous and dynamic chalk stream.

• Chalk-stream restoration has, to date, been largely carried out at the reach-scale on an opportunistic basis, taking advantage of available funding. Reach-scale projects can and do make a tangible difference. There is an opportunity to magnify their impact, however, by adding multiple reach-scale improvements together so that they operate at the catchment scale: this landscape-scale change and habitat restoration is how we will start to see really significant improvements.

• The CaBA chalk stream restoration strategy offers an excellent opportunity to do just this, starting with a national network of flagship catchment-restoration projects in which *all* aspects of the CaBA plan are to be given maximum possible expression. New environmental schemes, such as the Sustainable Farming Incentive, Nature Recovery Network and Biodiversity Net Gain, all offer tremendous opportunities to bring about landscape-scale re-naturalisation.

• Only at this catchment-scale will we properly bring the three components of our discussion together – water quantity, water quality and physical habitat quality – into a form of river restoration which magnifies the improvements made in any one aspect, by combining them with improvements in the other two.

Summary – recommended key actions

The CaBA Chalk Stream Restoration Group has recommended key actions under the headings of **water quantity**, **water quality, physical habitat quality** and **integrated policies.** These recommendations are ambitious but pragmatic.

As much as possible, it has been the intention of the CaBA CSRG to find a consensus agreement to all these recommendations for action, but this is not always straightforward: for example, some require changes to legislation. That being a political process government agencies on the CSRG must be wary of seeming to show partiality. Furthermore, many of these actions would require additional government funding, or water company investment, and the processes of enabling that funding/investment are not necessarily in the gift of the CaBA group. We have tried to identify and agree what needs to be done. Some of the recommended actions are already underway. Some will be facilitated by a strong steer from the government or even changes in legislation.

One big wish – enhanced status for all chalk streams

As will be shown in this report, people who are passionate about chalk streams have asked for one big thing again and again over the last twenty years and that is for the government to give chalk streams a status which reflects the fact that these rivers are not just locally precious, but globally unique, by providing a statutory driver for the investment needed to restore their ecological status.

Seven chalk stream catchments are currently designated as Sites of Special Scientific Interest (SSSI) and four as Special Areas of Conservation (SAC)*, the latter our highest designation. These streams are designated for particular reasons which mark them out even amongst chalk streams, but the results of their enhanced protection are obvious when you look at the investment afforded to their protection in comparison with the rest.

All chalk streams are classified as Priority Habitat, and once they were THE river Priority Habitat, with their own investment driver: the Biodiversity Action Plan (BAP) Priority Habitat driver. Now, chalk rivers are one of a subset of criteria of Priority Habitat, and the designation itself has not always been that powerful.

Over and over, while preparing this report, it has been made clear that when it comes to the investment decisions which determine the health of our chalk streams – in reducing abstraction, or pollution or paying for habitat work – a powerful *statutory* driver makes all the difference. A statutory driver allows the regulators, industry and NGOs to do what they need to do to bring our chalk streams back to ecological health, not just in a few privileged places, but right across the map.

Rivers are found all over the world, but chalk streams are very largely English. They should be our pride and joy. Enhanced status which drives investment – whatever form that needs to take – will allow them to become so.

Charles Rangeley-Wilson. Chair CaBA Chalk Stream Restoration Group

*SSSI catchments: lower Frome / Bere Stream / Test / Kennet / Nar / Hull h'waters / River Crane (h'waters of Moors River) SAC catchments: Avon / Itchen / Wensum / Lambourn

Water quantity: recommendations for action

1. Defining sustainable abstraction	**CaBA CSRG agrees to set a target for "sustainable groundwater abstraction" in chalk stream catchments as that which causes a maximum reduction from natural flows[1] of circa 10% at Q95[2] determined at appropriate assessment points[3], and in winterbournes a maximum 10% increase in drying duration. These will be the agreed destination targets for chalk streams[4], but CaBA CSRG recognises that bespoke less or more stringent targets may be necessary to ensure appropriate[5] levels of ecological protection assessed at a local level; and that as flow targets are neared an adaptive response to the delivery of benefits may reasonably drive a change in the flow target.**
2. Reviewing Abstraction Sensitivity Banding	**CaBA CSRG recommends a review of the Abstraction Sensitivity Banding. All chalk streams should be banded ASB3, unless there is evidence to support a lower band. ASB3 may not be appropriate on the lower reaches of very big chalk catchments or highly modified systems, for example the lower Colne or Lea, the lower Wey, Gade, Stort etc.**
3. Enhanced scenario for the national framework	**CaBA CSRG therefore endorses the national framework's 'enhanced scenario' for chalk streams but based on local evidence. The restoration of flow deficits should be grouped as being either ecologically 'essential', 'beneficial' or 'of limited benefit' and prioritised accordingly. See section 4.6 National framework and section 4.6.5 A%R .**
4. Waterbody boundaries and assessment points	**The Environment Agency should set and publish a timetabled undertaking to review all chalk stream WFD waterbody assessment points, associated targets and boundaries and make changes to ensure that the EFI methodology adequately protects ephemeral and headwater chalk streams and is appropriately applied in reaches where flow is of lesser significance such as the lower reaches.**
5. Time-bound goals towards sustainable abstraction	**Following items 1 - 4 government, regulators and industry should set and publish time-bound goals (short, medium and long-term) towards achieving 'sustainable abstraction' (see Action 1) on all chalk streams, in accordance with regional planning process and the recommended prioritisation articulated in Section 4.6.**

1. Modelling natural flows in abstracted streams is not an exact science: constant revision and refinement are necessary to enhance knowledge.

2. This figure is not a hands-off flow and it does not preclude conjunctive abstraction or the potential role of abstraction in the management of groundwater levels. The intention is to manage total annual groundwater abstraction in such a way that flows fall within 10% of natural at Q95.

3. A review of EA assessment points and their associated flow targets to "ensure that the methodology enables protection appropriate to the differing characteristics of ephemeral, and headwater and lowland chalk streams" is covered in a separate action: "appropriate" in this context must include that intention.

4. See Action 5. ref delivering time-bound (short, medium and long-term) commitments to the delivery of this target.

5. See Section '4.4 National framework' and the need to distinguish between and prioritise the restoration of flow deficits according to a tiered assessment of ecological sensitivity: "essential" "beneficial" "of limited benefit".

Water quantity: recommendations for action.	
6. Evidence	**Where existing (or future revised) methodologies indicate that abstraction is causing environmental stress or damage the EA should gather evidence: this will require investment in assessment points and monitoring.**
7. Reviewing the Abstraction Incentive Mechanism (AIM)	**Ofwat should review the Abstraction Incentive Mechanism to ensure that it is fit for purpose and if or how it can be adapted to increase effectiveness.**
8. Demand management	**All areas dependent on water-resource supply from chalk aquifer groundwater abstraction should be defined as Water-Stressed, enabling compulsory metering. Water companies should set and publish time-bound goals to achieve complete water-meter coverage in these areas. Joined-up action should be taken to influence customer behaviour to reduce demand for water, including education, labelling of goods and building regulations. A related call to drive water-efficiency standards is included in integrated policy recommendations for action section 7.4**
9. Flow-recovery flagship	**Government, regulators and industry should set a short-term goal to achieve sustainable abstraction in the chalk tributaries of the Colne and Lea catchments, where a technical solution is available within a shorter time-frame because of existing infrastructure plans, as set out in the *Chalk Streams First* proposal. This scheme has the potential to re-naturalise flows in the chalk streams most acutely impacted by groundwater abstraction, representing 20% of the chalk-stream waterbodies where flow does not support good ecological status.**
10. Independent review of abstraction as a % of recharge (A%R)	**CaBA CSRG recommends extending to all chalk streams the preliminary independent review of abstraction as a % of catchment recharge (A%R) for chalk streams in order to a) understand the scale of groundwater abstraction in chalk-stream catchments and b) to investigate A%R as a simple and accessible method for independent assessment of abstraction impact and prioritising action.**
11. The importance of modelling and knowledge sharing	**While A%R is a simple and accessible screening tool, CaBA CSRG also recognises the need for detailed models of run-off, aquifer recharge, groundwater levels and river flows as other components of the suite of tools and data that will support decision-making on chalk-stream restoration interventions. To include stakeholders in the discussion and decision-making, a participatory approach to modelling and data-sharing should be adopted.**

Water quality: recommendations for action.

1. Sewage-treatment works that do not strip phosphorus	CaBA CSRG recommends the EA reviews the status the sewage-treatment works on all chalk-stream waterbodies that are at poor, moderate or bad status for phosphorus, and prioritises and timetables remediation via WINEP. Tighter phosphorus limits should be considered for designated priority habitat.
2. Integrated constructed wetlands	Notwithstanding changes to CBA (See Action2 under integrated recommendations) CaBA CSRG endorses the use of integrated constructed wetlands (ICW) at small, remote works where conventional treatment is too difficult or expensive and of catchment-scale nutrient-reduction strategies so that the benefits afforded by nature-based solutions (such as ICWs) can be maximised whilst ensuring that ecological targets are met using STW upgrades where necessary.
3. Waterbody boundaries and assessment points	As with water quantity recommendation 4, the Environment Agency should set and publish a timetabled undertaking to review all chalk stream WFD waterbody assessment points and boundaries to ensure that they provide adequate means of assessing and protecting chalk-stream health.
4. Storm overflows	CaBA CSRG recommends all necessary actions be taken to achieve significant reductions in the frequency and volume of overflows to chalk streams to ensure they are adequately protected from ecological harm and that their iconic status be recognised, including adoption of the findings of the storm overflow taskforce
5. Groundwater ingress at small works	CaBA CSRG recommends an investigation of the practicability of using ICWs as a cost-effective measure to mitigate the impacts of storm overflows caused by groundwater ingress into the sewer network. With a view to the limitations of ICWs ref size of works and spatial area of available land, this is likely to relate to smaller works in rural settings.
6. Septic tank hot-spots	CaBA CSRG recommends a review of SAGIS and / or a programme of research to identify septic tank 'hot-spots' in chalk stream catchments and based on evidence of harm a pilot trial of monitoring and policing poor septic tank performance.
7. Septic tank point of sale	CaBA CSRG recommends a law that requires homeowners at point of sale to register and bring septic tanks up to standard.
8. Farming rules for chalk streams	CaBA CSRG recommends that the compulsory rules for farming in chalk stream catchments set out in section 5.9.3 be adopted into the new Sustainable Farming Incentive (SFI).
9. Farming incentives for chalk streams	CaBA CSRG recommends that new ELM incentive schemes beyond SFI be structured so as to enable changes to habitat restoration at the catchment scale, taking critical land areas out of production, prioritising the restoration of headwater, spring-line fens and flushes, riparian zones and large tracts of floodplain.
10. Highways	Roads are the primary pathway of sediment to chalk streams from their catchments and therefore roadside drainage grips should not feed directly into chalk streams or unplugged drains which feed into chalk streams. Highways Agency standard practice for construction / maintenance of roadside grips that discharge run-off to chalk streams must either: discharge to plugged ditches or to settlement areas.
11. Aquaculture	EA to work with relevant trade associations to provide updated technical guidance notes for cress and fish farming and also to review permitting approach.

Physical habitat: recommendations for action.	
1. Principles of chalk stream restoration	CaBA CSRG endorses the key foundations and principles of chalk stream restoration set out in Section 6.6 and 6.6.1 agreeing that the chalk stream restoration, should be a restoration of that which catalyses process: the natural gradient of the river, an intact river bed, a dynamic interconnection between the river and the floodplain, and through all the above the restoration of the ecological processes and the habitat requirements of the ecosystem engineers (fish, insects, mammals and plants) that shape a truly heterogenous and dynamic habitat.
2. Flagship restoration projects	CaBA CSRG will work with water companies and other partners to deliver a national network of flagship catchment restoration projects as set out in Section 7. The aim is to realise on these flagships streams all the dimensions of ambition the CaBA strategy has articulated, to show what is possible and to act as exemplars to assist in the restoration of other chalk catchments.
3. Urban chalk streams	CaBA CSRG endorses the use of urban and public chalk stream spaces as sites for Biodiversity Net Gain and for inclusion in Nature Recovery Networks and Local Nature Recovery Strategies.
3. Monitoring and appraisal	CaBA CSRG endorses the development of a simple, replicable and standardised monitoring initiative, covering the key components of habitat, biology, quality and flow in perennial and winterbourne reaches. Delivery through engaging citizen scientists and conservation volunteers would help to build links between various stakeholder communities and lead to better appraisal of the evolution of environmental projects and their long-term impacts.
4. Sharing best practice / pooling expertise	In addition to and complementing this flagship initiative, CaBA CSRG is working towards the establishment of: • a CaBA chalk stream online data and information hub. This will be hosted by the Rivers Trust. It will include data and knowledge to help empower and facilitate grass-roots catchment advocacy and river restoration • a manual of best-practice restoration principles and guidelines and a forum for sharing best practice and experience • a annual CaBA chalk stream restoration conference and programme of site visits, again to promote an open and exciting exchange of information, experience and best practice among those who are passionate about rivers in general and chalk streams in particular
5. Research into reference conditions	There is a need for further research into the reference conditions and characteristics of the different groups of chalk streams to inform our knowledge and understanding of the practice and aims of river restoration.
6. Database of reference reaches	Although they are rare, relatively natural reaches of chalk streams do exist, as do reaches where naturalness is being recovered through river processes or restoration. These reference reaches should be recorded, mapped and surveyed to add to our knowledge base.
7. Chalk-stream map	An important first step in the protection of a natural resource such as a chalk stream is to accurately map the resource. Natural England is working on a complete and agreed map of all English chalk streams. This will be published by Natural England but it will also be included on the CaBA Chalk Stream online hub.

Integrated policies: recommendations for action.

1. One big wish*	**CaBA CSRG recommends that the government create an overarching statutory protection and priority status for chalk streams and their catchments to give them a distinct identity and to drive investment in water-resources infrastructure, water treatment, stronger planning controls and catchment-scale restoration.** **This is the one big ask arising from this strategy, and is the key to unlocking so many of the other components.**
2. Review of cost-benefit analysis / economic appraisal*	**CaBA CSRG recommends a review of cost-benefit analysis:** **• water companies' customer surveys for PR24 should ensure that they fully cover the environmental impacts of water company assets on chalk streams and make the importance of these iconic habitats clear to respondents, including in depth studies where chalk streams cover a significant component of their area served** **• Defra / EA should review how the proposals for WINEP reform and revised optioneering and appraisal guidance could be strengthened to ensure that improvements to chalk streams are valued appropriately** **• innovative approaches to capturing the full range of benefits generated by improvements to chalk streams should be trialled on the chalk-stream flagship projects** **• consideration should also be given to carrying out a new valuation survey for a chalk stream similar to the earlier study for the Mimram**
3. Development Rules for chalk streams	**CaBA CSRG recommends that the National Planning Policy Framework should be reviewed and include 'development and planning rules for chalk streams' (matching the 'farming rules for chalk streams' outlined in 5.8.3). Guidelines and recommendations for these rules are set out in Section 7.3.1 above.**
4. Commitment to develop and publish an implementation plan.	**CaBA CSRG will publish within 12 months an implementation plan for the headline actions identified in this strategy.**

* In theory, a reformed cost-benefit analysis process, one that adequately values the iconic status of chalk streams and the measures needed to improve their ecological status, would drive investment in many of the ways in which a statutory protection & priority status would. However, an explicit statutory protection & priority status would be more potently symbolic and comprehensible to the general public and so remains a fundamental CSRG recommendation. Either way, Defra might consider how the recommendation for a new statutory protection & priority status raises the importance of chalk streams and thus the need for priority attention to be given to specific aspects and benefits (arguably improvements to a designated site should accrue more benefits). The challenge, with or without a new statutory protection, is to ensure that the CBA process duly delivers such benefits.